



Integrated Sensor Is Structure (ISIS)

Tim Clark

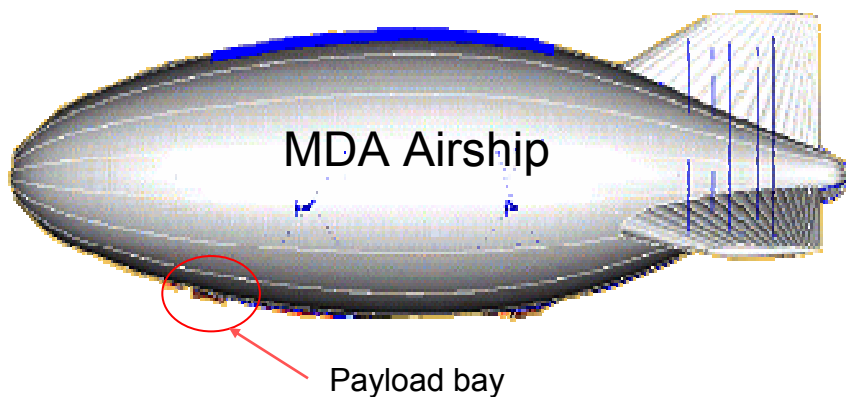
DARPA Special Projects Office (SPO)

24 August 2005



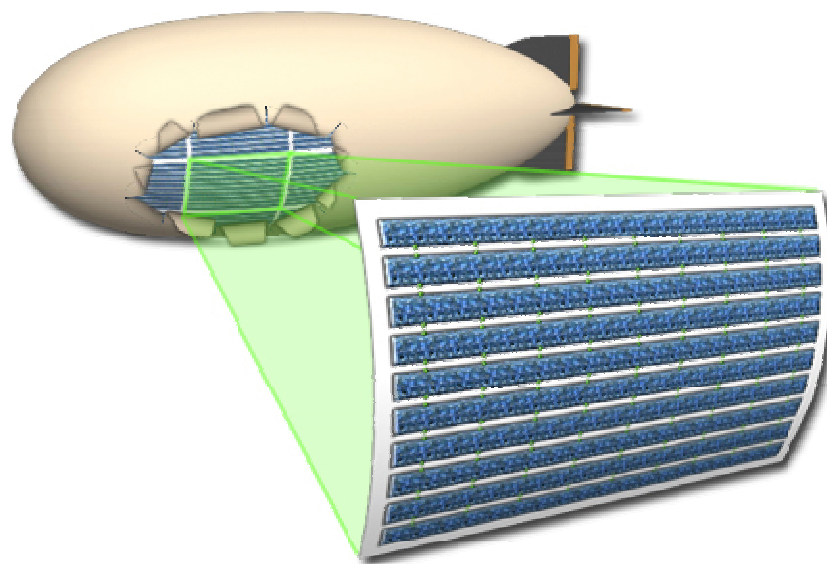
A New Design Philosophy

Capability cannot be added to airship after development



Payload: 1.7% of system mass

ISIS requires integration of sensor and airship



Payload: 30-40% of system mass

ISIS requires next generation multifunction structures and systems



Most Powerful Airborne GMTI/AMTI Radar & Comms Ever Conceived

Simultaneous AMTI/GMTI Operation via Dual Band (UHF/X-Band) Aperture

Cruise Missile Defense

Long-range AMTI/GMTI/COMM



Detect/Track Dismounts

Steep Grazing Angles

FOPEN GMTI

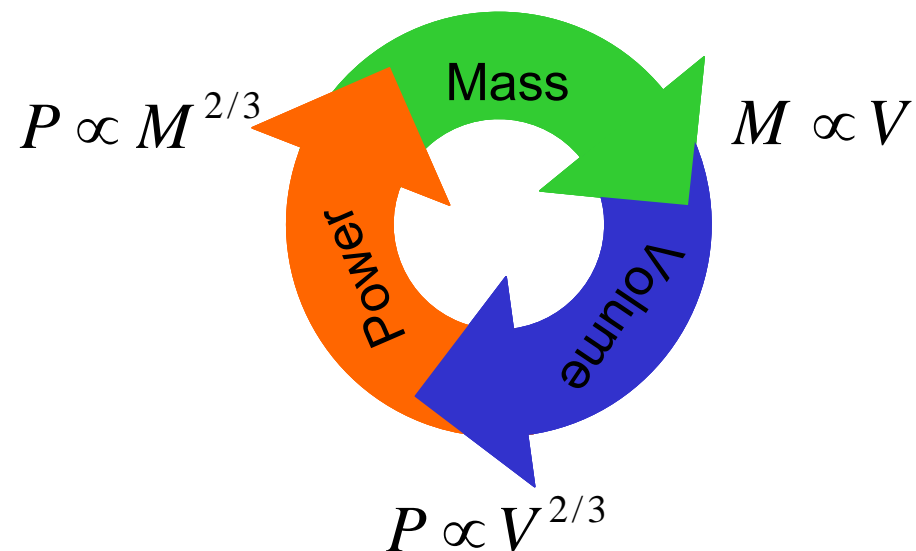
Extremely High Capacity Comms

Near Zero Platform Speed

No In-Theater Ground Support – 99% on station availability for 1+ years
600km radar horizon at 70kft operational altitude

Requires Mass Reductions

- ISIS designs are mass-centric
 - Lifting gas has reached the maximum limit:
 - 0.061kg per 1m³ of He @ 21km
 - 0.066kg per 1m³ of H₂ @ 21km
- ISIS focusing on:
 - Removing mass from largest contributors
 - Technologies improving integration



Integration

$$M_{displacedir} = M_{liftinggas} + \boxed{M_{structure} + M_{radar} + M_{power}} + M_{propulsion} + M_{avionics}$$

$$M_{ISIS} = \rho_{gas} V + \underbrace{c_h \rho_{hull}}_{\text{Components}} V^{2/3} + \underbrace{\rho_{aperture}}_{\text{Components}} A + \underbrace{\frac{\rho_{power}}{\eta_{power}} \left(P_{radar} + \frac{\rho_{air} C_d V^{2/3} v^3}{2\eta_{propulsion}} \right)}_{\text{Components}} + M_{propulsion} + M_{avionic}$$



Key Technology Objectives

- Payload-Platform integration provides 12dB reduction in system mass
 - HAA goal: ~2% payload → ISIS: 30-40% payload
- 10dB reduction in radar aperture mass
 - Current RF-on-Flex State-of-the-Art is 20 kg/m² → ISIS is 2 kg/m²
- 6dB reduction in airship hull mass
 - Current State-of-the-Art is 400 g/m² → ISIS is ≤100 g/m²
- Regenerative power: >50% system mass reduction
 - Better thermal properties → reduced pressure differentials and lower hoop stress

ISIS Schedule

